# PATENT SPECIFICATION (11) 1232494

1232494

DRAWINGS ATTACHED

(21) Application No. 56671/68 (22) Filed 29 Nov. 1968

(23) Complete Specification filed 3 Sept. 1969

(45) Complete Specification published 19 May 1971

(51) International Classification B 21 d 17/04

(52) Index at acceptance

B3E 10E3 10F 11C7 1H1
B3A 122J 122K 122S 137
B3W 22 55A 71E
E1K 1B1B 1B1F 1B1G



(72) Inventor ADAM ERIC SAYTES


## (54) PROCESS OF COLD FORMING STRUCTURAL STEEL SHAPES


(71) We, SIDERURGICA OCCIDENTAL C.A., a Body Corporate organised under the Laws of Venezuela, of Avda, 4 (Bella Vista), No. 85—160, Maracaibo, Venezuela, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—


This invention relates to a process for the fabrication of shapes from cold formed circular welded tubing.

Hot rolled steel structural shapes in the form of "I", "H", and channel beams having a solid cross section are old and well known. The hot forming rolling mill equipment required to form these conventional shapes is complex and costly. Highly trained and skilled personnel are required to operate this complex equipment.

This invention may be practiced in conjunction with well known and easily operated welded tube mills which only involve cold forming operations including the welding of the tube seam.

According to the present invention, in the process of cold forming structural steel shapes having transverse sections of enclosed form, a round welded steel tube is passed through successive forming rollers to progressively deform the tube by forcing its side portions together forming a web of parallel touching thicknesses of the wall of said tube, the top and bottom surfaces of the tube being flattened to form, above and below said web, flanges which may be substantially triangular and having outer surfaces substantially normal to said web. Preferably, the tube is deformed so that said weld is disposed substantially in the centre of one of said thicknesses of said tube forming the web.

Not only is the production of structural shapes by the process of this invention rapid, but the productive facilities required are far less costly than a conventional rolling mill. In addition, once set up, production may be carried out by relatively unskilled workers. The structural shapes produced by the process of this invention have a particularly high strength to weight ratio as a result of their hollow flange portions.

In the accompanying drawings:—

Figures 1—3, are, respectively, diagrammatic perspective views of a slitting stage, a preforming stage, and a forming and welding stage of a welded tube mill;

Figure 4 is a perspective view of mountings for rollers for the progressive deformation of welded steel tubing into structural shapes;

Figure 5 is a perspective view of a cut off unit for the structural shapes;

Figure 6 is a section through an "H" beam;

Figure 7 is a perspective view of the end of the "H" beam of Figure 6;

Figure 8 is a transverse section through a length of welded steel tubing from a conventional welded tube mill which may be progressively deformed into structural shapes in accordance with the process of this invention.

Figures 9—16 show the progressive deformation by sets of rollers of the tube of Figure 8 into the "H" beam of Figures 6 and 7;

Figures 17 and 18 show a clamp and knife for cutting off the structural shape of Figures 6 and 7;

Figure 19 is a transverse section through an "I" beam;

Figure 20 is a transverse section through a channel; and

Figure 21 is a perspective view of the end of the channel of Figure 20.

Referring to the drawings in detail, Figure 1 shows a coil 30 mounted on a holder 31. Coil 30 may be of hot or cold rolled steel from about .5 to 5 mm. thick. Sheet stock 32 is drawn from coil 30 through slitter 33 from which strips of sheet stock 34 slit

[F

to a desired width are rolled into slit coils 35 by winder 36.

As shown in Figure 2, the slit coils 35 may be joined and wound on a large reel 37. Referring now to Figure 3, suitable mountings 38 support pairs of vertical and horizontal motor driven rollers of hardened steel: These rollers (not shown) progressively deform the strip 34 until its edges meet. The mountings 38 for these preforming rollers are bolted to a table 39 or a like rigid support. The abutting edges of strip 34 are welded by any suitable welder 40 and passed through a cooling water spray at 41. All the foregoing elements, as described, are well known and constitute a tube mill for the production of welded seam tubing 44 as shown in FIGURE 8. Tubing 44 has a wall 45 of uniform thickness formed from the strip 34 which has its abutting edges 46 and 47 welded at 48. Weld 48 should be substantially the thickness of the strip 34 of wall 35.

FIGURE 4 shows mountings 51—58 fixed to an extension of table 39. The mountings 51—58 support, respectively, the sets of vertically mounted rollers 61—68 and the sets of horizontally mounted rollers 71—78 shown in FIGURES 9—16 progressively deforming the round tube 44 into an "H" beam structural shape 59. "H" beam 59 is shown in FIGURES 6 and 7. The "H" beam 59 has a central web 60 of two adjacent, substantially touching, and parallel thicknesses 69 and 70, one of which contains the weld 48 in its center. The flanges 79 of "H" beam 59 are best formed to be substantially triangular in shape with flat upper and lower portions 80 normal to web 60 and with inner portions 81 and 82 sloping toward the web 60. The outer edges 83 of the flanges 79 are best slightly rounded to avoid and distribute stresses which would otherwise be concentrated at these points.

In the progressive deformation of the round tube 44 into an "H" beam 59, the sides of the tube 44, one of which contains weld 48, are bent inward and flattened until they touch to form central web 60. At the same time, the flanges 79 are formed. At least one of each three sets of rollers 61—68 and 71—78 should be driven by any suitable means (not shown). It is particularly desirable to drive the last set of rollers 68 shown in FIGURE 16 as they may bear heavily inward against the touching thicknesses 69 and 70 of web 60 to provide traction. It is to be noted that the particular sets of forming rollers shown and theirc onfigurations are merely illustrative of the types which may be used.

FIGURE 5 shows a cut off unit for the "H"" beam structural shape 59. FIGURE 17 shows a pair of clamps 86 and 87 which engage beam 59 to allow the shear blade 88, shown in FIGURE 18, to make a clean cut off with a minimum amount of distortion at the cut off ends.

FIGURE 19 shows an "I" beam 90 which is made by the cold working progressive deformation of round welded steel tubing substantially in the same manner as that shown and described for "H" beam 59. "I" beam 90 has weld 48 in the center of one of the adjacent thicknesses 91 and 92 which form the web 93. The smaller flanges 94 of beam 90 are substantially triangular in shape with flat outer edges 95 normal to web 93 and with two inward sloping inner surfaces 96 extending from each outer edge or surface 95. The corners or edges of the flanges 94 are slightly rounded to reduce stress.

FIGURES 20 and 21 show a channel 100 which is formed by the progressive cold deformation of round welded steel tubing. Channel 100 has a central web 101 of inner and outer substantially touching thicknesses 102 and 103. The inner thickness 102 contains the weld 48 so that it will be in an area of minimum stress. The flanges 105 of channel 100 are substantially triangular with flat outer surfaces 106. Each flange 105 has a single sloping inner surface 107. The ends or continuations 108 of the outer thickness 103 of web 101 form one leg of the triangular flanges 105.

The structural shapes produced in accordance with the process of this invention may be painted or coated in any desired manner. They may also be formed from aluminium or other tubing if desired.

While this invention has been shown and described in the best form known, it will nevertheless be understood that this is purely exemplary and that modifications may be made without departing from the scope of the invention as set out in the appended claims.

WHAT WE CLAIM IS:—

1. In the process of cold forming structural steel shapes having transverse sections of enclosed form, the step of passing a round welded steel tube through successive forming rollers to progressively deform the tube by forcing its side portions together forming a web of parallel touching thicknesses of the wall of said tube while flattening its top and bottom surfaces to form flanges above and below said web.

2. The process according to Claim 1 wherein the top and bottom surfaces of said tubes are flattened and deformed to form substantially triangular flanges having outer surfaces substantially normal to said web.

3. The process according to either of claims 1 and 2 wherein said round welded tube contains a single weld, said tube being deformed so that said weld is disposed substantially in the center of one of said thicknesses of said tube forming said web.

4. The process of cold forming structural steel shapes, as claimed in claim 1, sub-

stantially as described herein with reference to the accompanying drawings.

5. Cold formed structural steel shapes produced by the process claimed in any one of claims 1 to 4.

For the Applicants,
CHATWIN & COMPANY,
Chartered Patent Agents,
253, Gray's Inn Road,
London, W.C.1.

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1971.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1232494 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG.1.

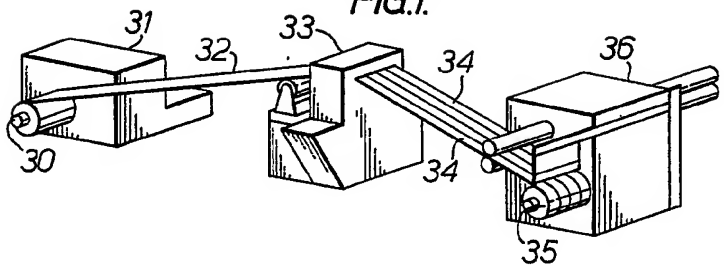



FIG.2.

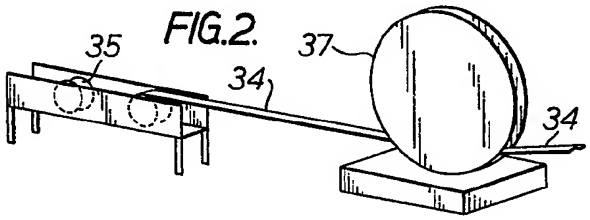



FIG.3.

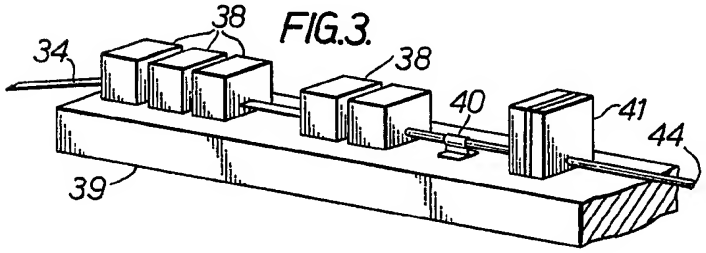



FIG.4.

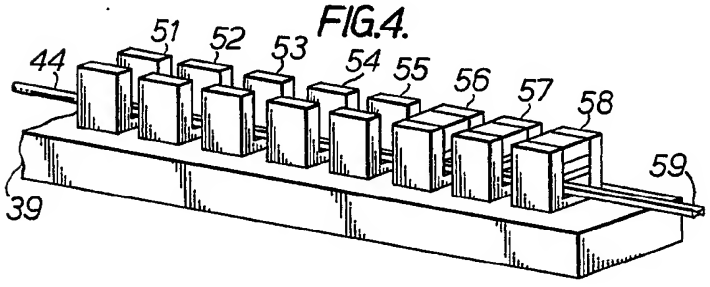


FIG.5.

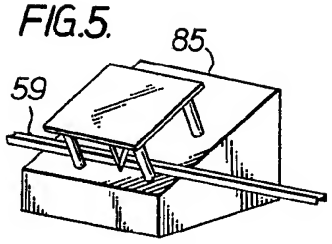



FIG.7.

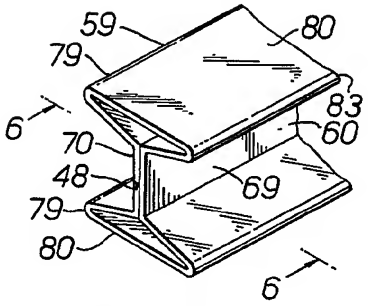



FIG.6.

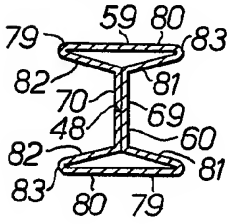



FIG.9.

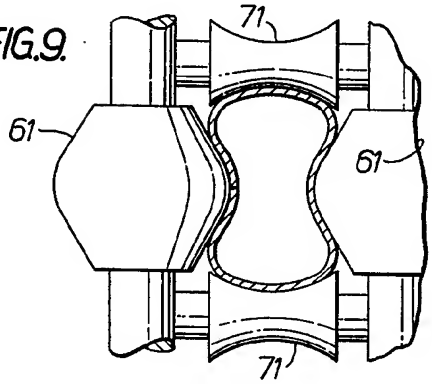



FIG.8.

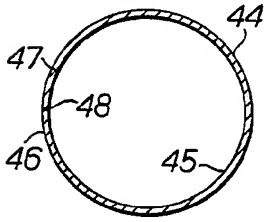
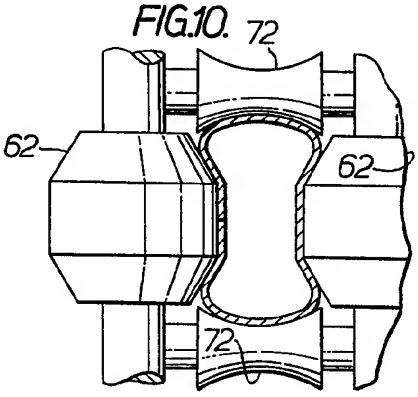



FIG.10.



1232494 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

FIG.11.

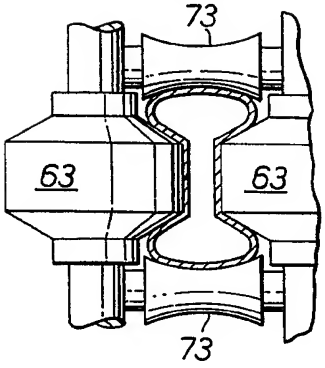



FIG.12.

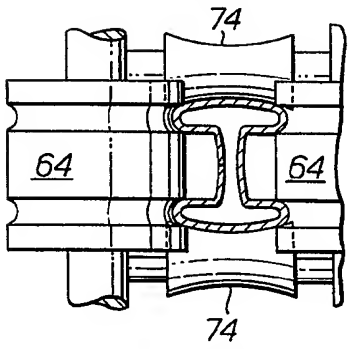



FIG.13.

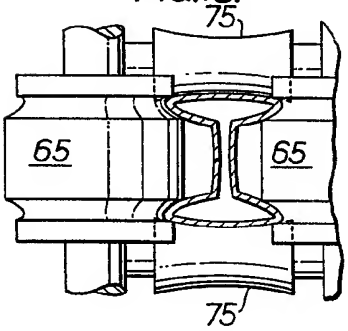



FIG.14.

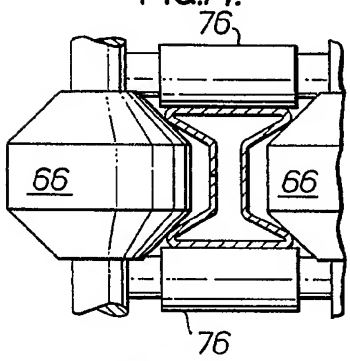



FIG.15.

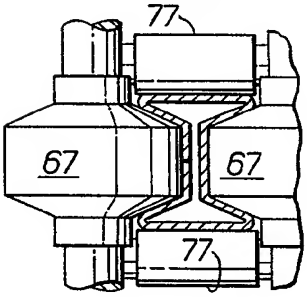
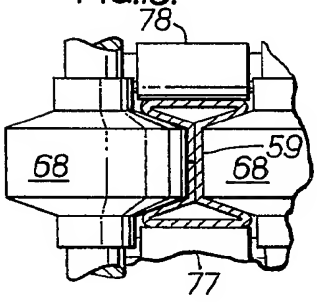



FIG.16.



1232494 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 4

FIG.17.

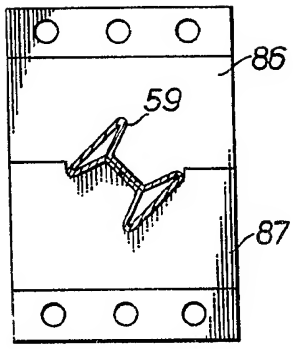



FIG.18.

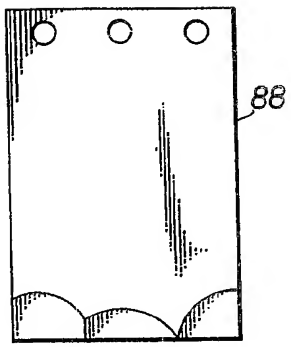



FIG.19.

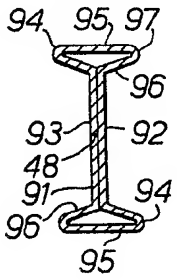



FIG.20.

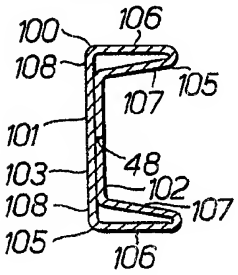



FIG.21.